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hensile power and becoming foliaceous, would no longer be called a tendril. In this last stage (that of the existing *L. nissolia*), the former tendril would reassume its original function of a leaf, and its lately largely developed stipules being no longer wanted would decrease in size." He believes that the capacity of acquiring the revolving power on which most climbers depend is inherent, though undeveloped, in almost every plant in the vegetable kingdom. Notwithstanding his peculiar views, which are so enticing to many, we must acknowledge that he is a shrewd and accurate observer, and that in this paper, as in many others, he has patiently collected a vast amount of valuable information upon a great variety of subjects.

REVIEWS.

NATURAL SELECTION.*—Mr. Wallace has here brought together, in a compact little book, all those essays which have laid the foundation of his great reputation as the author, in common with Mr. Darwin, of the theory of Natural Selection. The modesty of the author, and that admirable judicial coolness of mind which he shares in common with Darwin, is a most persuasive introduction, and produces a favorable disposition in the mind of the reader, which the candid style of treating the different subjects greatly strengthens. In fact we have rarely read a work which has given us so much pleasure and information, and we recommend it to all those who desire to get the principles of Darwinism but have not the patience to spend a longer time over Darwin's work.

The first chapter shows that geological changes determine the variations which take place in the geographical distribution of animals and plants; that closely allied animals are closely associated geographically and geologically, so that "every species has come into existence coincident both in time and space with a preëxisting closely allied species." The author then proceeds to show how variations in animals occur, and incidentally introduces an ingenious and remarkable explanation of the reversions of domesticated types when returned to a feral condition. A domesticated type, when allowed to become wild again, generally speak-

* Contributions to the Theory of Natural Selection. A Series of Essays by Alfred Russel Wallace, McMillan & Co., London and New York, 8vo, p. 384.

ing possesses modifications which are exceedingly disadvantageous; thus they must either regain the original characteristics of their ancestors or become extinct.

In treating of mimicry, or the protective resemblance which many insects have to the bark and leaves of trees, Mr. Wallace is particularly forcible and happy in his illustrations. The *Kallima inachis* and *K. paralexia* are perhaps the most remarkable examples of mimicry. In these two species the wings, when folded, precisely resemble a dead leaf, and since these insects never alight except on withered bushes, they are almost sure to escape detection. "We thus have size, color, form and habits all combining together to produce a disguise which may be said to be absolutely perfect." In the same manner numerous instances are given of similar resemblances occurring between animals in which a harmless species is protected by assuming a resemblance to another species endowed either with stings, disagreeable secretions, or some other peculiarities which render them obnoxious as objects of prey or food to birds. As we have before remarked in dealing with Darwinian theories, we cannot see in all this that natural selection is by any means the primary cause of variation.

Granting that all the variations occur as explained, it seems to become more and more evident that physical changes, or some other unknown causes, give the initiatory impetus to change. According to both Darwin and Wallace a variation must appear, and this variation must in some shape better adapt the animal to its surroundings, its physical wants, before natural selection can act. Thus in the experience of all practical naturalists it acts in such a manner that species have certain local characteristics which they share in common with other species from the same locality. Again, as cited by Wallace, the rise of a mountain system, or other geological revolutions, may produce great changes in the climate and corresponding revolutions in the flora and fauna of a region. We have never been able clearly to see why the plasticity of the organization, and the tendency to vary in any advantageous direction, as seems to be proved by the cases of protective mimicry, might not be acted upon with equal facility by physical causes, natural selection being only the secondary means by which these variations are perpetuated or transferred from individual to individual.

To our minds one of the most remarkable portions of this book is the bold and successful application of the theory to man, and the last chapter which treats of the limitations of natural selection.

It is shown that natural selection would cease to act upon the body after man had once reached a period at which the intellectual faculties began to appear, since then all necessity for farther physical change would be at an end.

"We are now, therefore, enabled to harmonise the conflicting views of anthropologists on this subject. Man may have been, indeed I believe must have been, once a homogeneous race; but it was at a period of which we have as yet discovered no remains, at a period so remote in his

history, that he had not yet acquired that wonderfully developed brain, the organ of the mind, which now, even in his lowest examples, raises him far above the highest brutes;—at a period when he had the form but hardly the nature of man, when he neither possessed human speech, nor those sympathetic and moral feelings which in a greater or less degree everywhere now distinguish the race. Just in proportion as these truly human faculties became developed in him, would his physical features become fixed and permanent, because the latter would be of less importance to his well being; he would be kept in harmony with the slowly changing universe around him, by an advance in mind, rather than by a change in body. If, therefore, we are of opinion that he was not really man till these higher faculties were fully developed, we may fairly assert that there were many originally distinct races of men; while, if we think that a being closely resembling us in form and structure, but with mental faculties scarcely raised above the brute, must still be considered to have been human, we are fully entitled to maintain the common origin of all mankind.”

With regard to the limits of the action of this law we quote the following interesting and important argument :

“Mr. Darwin himself has taken care to impress upon us, that “natural selection” has no power to produce absolute perfection but only relative perfection, no power to advance any being much beyond his fellow beings, but only just so much beyond them as to enable it to survive them in the struggle for existence. Still less has it any power to produce modifications which are in any degree injurious to its possessor, and Mr. Darwin frequently uses the strong expression, that a single case of this kind would be fatal to his theory. If, therefore, we find in man any characters, which all the evidence we can obtain goes to show would have been actually injurious to him on their first appearance, they could not possibly have been produced by natural selection. Neither could any specially developed organ have been so produced if it had been merely useless to him, or if its use were not proportionate to its degree of development. Such cases as these would prove, that some other law, or some other power, than “natural selection” had been at work.”

The author then proceeds to show that the brain of the savage is uselessly large, being on an average over two and a half times the capacity of that of a Gorilla and nearly seven-eighths of the average Caucasian, or civilized European. This reserve power in the savage, as shown by the size of the unused brain, cannot be accounted for by natural selection, since it is evidently, as shown above, something provided which is not in use and for which a daily necessity does not exist.

The hairless condition of the back in man is also, as pointed out by Mr. Wallace, a characteristic which among naked savages is decidedly a disadvantage and equally unaccountable on the principles of natural selection.

We have already pointed out in previous reviews other cases in which exceptions to the action of the law of natural selection might be found, especially among the fossils. Instead of repeating these remarks we would refer the reader to a series of articles published in the “Scientific Opinion.”* These present, by far, the ablest refutation of the universality of application claimed for the great theory of the day. This, together with Professor Dawson’s “Modern Ideas of Derivation,” reviewed in a previous number of this magazine, and Professor Cope’s “Origin of Genera,” give fair views of the principal arguments urged against the somewhat unquestioning and hasty acceptance of Darwinism which seems to have become the fashion.

* The Difficulties of the Theory of Natural Selection. *Scientific Opinion*, Nov. 10, Dec. 1, 1869. Nos. 54-57, Vol. 2.

And here permit us to repeat, by way of explanation, that Darwinism does not mean the theory of development or derivation, pure and simple, as so many insist, but that explanation of its action by the law of natural selection which is given by Wallace and Darwin. We have no objections to urge against the theory which accounts for the origin of species by descent from some ancient and simpler forms, which might be appropriately called Lamarckianism, but only against the universality of the law of natural selection. This is applied to the solution of the origin of all the various modifications of form and characteristics which have arisen since the first appearance of life upon the globe, whereas it is evidently only a secondary law, active perhaps in all species but subordinated to some other and more comprehensive law still undiscovered.

As regards the origin of man himself our author takes the ground that "some higher intelligence may have directed the process by which the human race was developed by means of more subtle agencies than we are acquainted with.

At the same time I must confess, that this theory has the disadvantage of requiring the intervention of some distinct individual intelligence, to aid in the production of what we can hardly avoid considering as the ultimate aim and outcome of all organized existence—intellectual, ever-advancing, spiritual man. It therefore implies, that the great laws which govern the material universe were insufficient for his production, unless we consider (as we may fairly do) that the controlling action of such higher intelligences is a necessary part of those laws, just as the action of all surrounding organisms is one of the agencies in organic development. But even if my particular view should not be the true one, the difficulties I have put forward remain, and I think prove, that some more general and more fundamental law underlies that of "natural selection." The law of "unconscious intelligence" pervading all organic nature, put forth by Dr. Laycock and adopted by Mr. Murphy, is such a law; but to my mind it has the double disadvantage of being both unintelligible and incapable of any kind of proof. It is more probable, that the true law lies too deep for us to discover it; but there seems to me, to be ample indications that such a law does exist, and is probably connected with the absolute origin of life and organization.

In this connection read the original thoughts in the closing paragraphs on "The Nature of Matter," "Matter is Force," "All Force is probably Will-force," expressed in brief thus: "if, therefore, we have traced one force, however minute, to an origin in our own WILL, while we have no knowledge of any other primary cause of force, it does not seem an improbable conclusion that all force may be will-force; and thus, that the whole universe is, not merely dependent on, but actually *is*, the WILL of higher intelligences or of one Supreme Intelligence."

AMERICAN MICROSCOPES AND THEIR MERITS.* — The first of these papers is an elaborate attempt at an account of American microscopes and their merits; but should have more properly been entitled an attempt to describe the microscopes made by R. B. Tolles, as of the twenty-five pages which it covers, twenty are given to Tolles. The second article

* On the North American Microscope. By Dr. H. Hagen, Cambridge, Mass. Max Schultz's Archiv für Microscopische Anatomie. Bonn. 2d No. 1870. A communication by Dr. H. Hagen on his experience in the use of the microscope. Proceedings of the Boston Society of Natural History, vol. xii, p. 357. March 10th, 1869. A verbal communication on Tolles's and Scheick's microscopes, to the Boston Society of Natural History, November 10th, 1869. Unpublished.